

September 5, 2017

MEMORANDUM FOR: Ian Mead
Assistant Administrator for Energy Analysis

FROM: Jim Diefenderfer
Director, Office of Electricity, Coal, Nuclear, and Renewables Analysis

SUBJECT: Summary of AEO2018 Renewable Electricity Working Group held on
August 1, 2017

The working group presentation provided discussion of the data and modeling updates expected for the AEO2018 Reference case in relation to renewables, along with potential side case scenarios. These updates are included in the presentation materials provided in a separate document on EIA's website.

Model updates

The meeting began by presenting the cases that would likely be included in AEO2018. In addition to the Reference case, which is based on current laws and policies, the following side cases were mentioned as likely candidates for alternative scenarios based on past AEOs and current developments:

- High/low Oil and Gas Resource and Technology
- High/low Oil Price
- High/low Economic Growth
- Extended Policies
- Energy Storage

However, participants were also informed that the details surrounding the final set of side cases has yet to be determined.

The presentation then turned towards electric power sector updates being considered for AEO2018 and beyond:

- Improved representation of renewable generation sources
- Assessment of parameters that are impacted by increased generation variable generation
- Integration of energy storage as a capacity expansion option
- Reassessment of data sources for potential hydro builds
- Enhanced representation of Renewable Portfolio Standards
- Reconsideration of the electric power price structure representation in the context of increasing deployment of distributed generation
- Revaluation of the cost of capital to finance new generating capacity by owner type

**WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES ONLY.
DO NOT QUOTE OR CITE AS RESULTS ARE SUBJECT TO CHANGE.**

Discussion

The discussion following the presentation focused on a number of more detailed topics, ranging from wind turbine additions to renewable financing.

Wind Turbine Technology Additions

A participant questioned EIA's proposed method for basing the selection of the additional wind on both taller hub heights and longer turbine blades. The participant suggested that a comparison between an 80 meter hub height and a 100 meter hub height would provide more interesting and useful results, since blade length has become uniform across the industry. EIA staff agreed with this assessment and inquired about hub height maximums to consider. Another participant stated that hub heights of 115 meters to 117 meters are the maximum elevations currently seen in the U.S.

Solar Resource Supply Curve

EIA staff mentioned that there has been difficulty in obtaining solar resource maps for the purpose of examining solar land exclusion. A WebEx participant suggested that EIA staff look at NREL GIS solar maps, since NREL had previously done some work with respect to land exclusion in a more recent report. EIA staff thanked the participant for their recommendation.

Curtailement

On the topic of curtailments the discussion focused on EIA's proposed method for calculating curtailments. Participants noted that even when generators are curtailed they can still provide operating reserves, a point that EIA staff upheld. Participants recommended that EIA staff look at ERCOT and CAISO studies regarding curtailments and operating reserves for renewables.

A participant asked for clarification on the definition of capacity credit, while another questioned how EIA staff intends to prioritize benefits in curtailment. EIA staff responded that the value for renewables is a function of the capacity provided and the time of day the generation occurs.

Hydro

EIA discussed that analyses are underway to consider updating the current hydropower resource curve with recent resource assessments from Oak Ridge National Lab (ORNL) on New Stream-reach Development and Non-Powered Dams. It was noted that careful consideration will have to be given to the economic evaluation of the resources identified in ORNL's assessments, since EIA's model considers both resources and economics. Participants also suggested considering the costs for new power transmission that non-powered dams may incur.

Utility Rate Structure

In terms of utility rate structure, EIA staff discussed the three pricing schemes they plan to examine—time-of-use pricing signal in the wholesale generation prices, compensation at the wholesale price rather than at an all-in retail price of electricity, or a fixed annual charge in lieu of a per-kWh charge. While all options are still being investigated, EIA indicated that it may change the distributed generation compensation from a retail rate to a wholesale market price. Participants immediately pointed out how highly controversial this could be. EIA staff recognized the controversial nature of the proposal.

However, there is a requirement for grid operators to maintain grid reliability. Discussion moved to how states have been changing net metering rules currently, and EIA staff on the WebEx discussed that many states have made changes and they are moving towards wholesale market prices. EIA will continue to study the various options before making changes for the AEO2018.

Renewable Energy Financing

A participant asked questions about how EIA staff is modeling the supply of tax equity, and whether EIA staff is allowing the supply of tax equity to decrease. EIA staff replied that the supply of tax equity is being modeled and is allowed to decrease over time. A participant also asked if EIA does an evaluation on user preferences for project types with tax equity, or do tax equity providers have preference for one technology over another. EIA does not currently evaluate user preferences, nor are there current plans to consider these user preferences.

Additional issues

Participants raised a concern regarding the learning rate for onshore wind used in the NEMS model. Several participants commented that they felt the learning rate NEMS uses for wind learning is too low. EIA staff discussed the issues with participants, but agreed to follow-up with regard to the particular parameters used in NEMS. Follow-up on the topic indicates that gross cost declines for wind have historically been around 5% per doubling (measuring U.S. installations from 1983), which is the result of market-based learning, non-technology factors (materials costs, etc.), and non-market R&D. The AEO 2017 Reference case projects wind cost reductions of 7% per doubling, accounting only for market and non-market factors in the model, or 20% per doubling rate when also accounting for a materials cost index.

Attendees

The working group meeting was attended by thirty-three people in person and seventeen people over the WebEx, including both EIA staff and external participants.

Guests (in person)

| Last | First | Affiliation |
|-----------------|--------------|---|
| Beek | Torrey | Oceana |
| Bergman | Aaron | Department of Energy |
| Boyd | Erin | Department of Energy |
| Donohoo-Vallett | Paul | Department of Energy |
| Googin | Michael | American Wind Energy Association |
| Hensley | John | American Wind Energy Association |
| Hunt | Hannah | American Wind Energy Association |
| Khzir | Lauren | National Rural Electric Cooperative Association |
| Liefman | Michael | General Electric |
| Mai | Trieu | National Renewable Energy Laboratory |
| Shultz | Avi | Department of Energy |
| Sterzinger | George | American Waste to Energy, LLC |
| Wanner | Celeste | American Wind Energy Association |

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Guests (WebEx/phone)

| Last | First | Affiliation |
|-------------|--------------|---|
| Augustine | Chad | National Renewable Energy Laboratory |
| Baca | Justin | Solar Energy Industries Association |
| Chatterjee | Digaunto | General Electric |
| Cole | Wesley | National Renewable Energy Laboratory |
| Feldman | David | National Renewable Energy Laboratory |
| Larsen | John | Rhodium Group |
| Luckow | Patrick | Synapse |
| Rumery | Shawn | Solar Energy Industries Association |
| Tucker | Russell | National Rural Electric Cooperative Association |
| White | David | Synapse |
| Wilson | Thomas | Electric Power Research Institute |

EIA attendees (in person)

| Last | First | Affiliation |
|--------------|--------------|--------------------|
| Blessing | Colleen | EIA |
| Boedecker | Erin | EIA |
| Bowers | Richard | EIA |
| Bowman | Michelle | EIA |
| Conti | John | EIA |
| Diefenderfer | Jim | EIA |
| Dubin | Kenneth | EIA |
| Fickling | Meera | EIA |
| Gruenspecht | Howard | EIA |
| Jarzomski | Kevin | EIA |
| Jell | Scott | EIA |
| Klaiman | Kimmie | EIA |
| Kwon | Augustine | EIA |
| Marcy | Cara | EIA |
| Mead | Ian | EIA |
| Moses | Carolyn | EIA |
| Namovicz | Chris | EIA |
| Neff | Shirley | EIA |
| Stein | Adam | EIA Contractor |
| Sukunta | Manussawee | EIA |

EIA attendees (WebEx/phone)

| Last | First | Affiliation |
|-------------|--------------|--------------------|
|-------------|--------------|--------------------|

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|----------|---------|-----|
| Hojjati | Behjat | EIA |
| Cole | Michael | EIA |
| Martin | Laura | EIA |
| Jones | Jeffrey | EIA |
| Manzagol | Nilay | EIA |
| White | Carol | EIA |